5 MICROSCOPIC COMPARISON

5.1 Introduction

A comparison microscope allows an examiner to identify a fired component back to the firearm that produced the markings on the evidence or identify a toolmark back to the tool that produced the mark. The evidence component is placed on one stage of the microscope, and the known standard is placed on the other stage. This procedure may also be used to compare two unknown fired components or two toolmarks to determine if they were fired in/from the same firearm or were produced by the same tool.

5.2 Safety Considerations

Examinations performed in the Firearm and Toolmark Section are inherently hazardous. These procedures involve hazardous chemicals, firearms, ammunition, and power tools. All hazardous procedures must be performed in compliance with the DFS Safety Manual.

5.3 Preparation

NONE

5.4 Instrumentation

- Comparison Microscope
- Stereo Microscope

5.5 Minimum Analytical Standards and Controls

NONE

5.6 Procedure or Analysis

The procedure steps below do not have to be performed in the order listed; however, all steps should be considered and/or addressed, as appropriate:

5.6.1 Comparison Microscope Set-up Procedure

- Select the same objective (magnification) setting and ensure that the objectives are locked in place
- Select the same set of oculars (eyepieces)
- The illumination (lights) used must be properly adjusted, (oblique lighting is usually preferred)

5.6.2 Analysis of Comparisons

5.6.2.1 With Firearm or Tool as Evidence

Compare the test fires produced from the firearm or tests produced from a tool to determine what microscopic characteristics are reproducing.

5.6.2.2 Without Firearm or Tool as Evidence

Compare unknown evidence to either another piece of unknown evidence or a known standard by placing the unknown evidence on the left-hand stage or the other piece of unknown evidence or known standard on the right-hand stage.

5.6.2.3 Identification Not Evident

Considerations if identification is not initially evident

- Angle of lights
- Type of lights
- Need for additional known standards
- Position of the evidence, the tests, or both
- Possibility of using magnesium smoke
- Possibility of cleaning the firearm or tool and producing new tests
- Possibility that the firearm or tool has changed
- Possibility that a different firearm or tool was used
- The entire unknown should be considered

5.6.3 Interpretation of Results

As delineated below in sections 5.6.3.1, 5.6.3.2 and 5.6.3.3, photomicrographs or detailed descriptions will be made of marks used for identification, inconclusive findings and eliminations. Oriented index marks (e.g., blue index mark at 6 o'clock) or orientation marks (such as drag mark at 3 o'clock) on compared items will be used for identification documentation.

5.6.3.1 Identification

Criteria: Agreement of a combination of individual characteristics and all discernable class characteristics where the extent of agreement exceeds that which can occur in the comparison of toolmarks made by different tools and is consistent with the agreement demonstrated by toolmarks known to have been produced by the same tool.

Documentation: Either a photomicrograph or a detailed description will be made of the marks that are used as the basis of the identification. Other marks that are examined, but are not used as the basis for the identification, should be documented. It is not necessary to provide photographs or describe the marks appearance in detail; for example, cartridge cases which are identified based on firing pin impressions and breechface marks should be documented with a photograph or detailed description of marks used in the firing pin impression and breechface. However, no photographs or detailed descriptions are necessary for the chamber marks, extractor marks or ejector marks, if present.

5.6.3.2 Inconclusive

Criteria: (1) Some agreement of individual characteristics and all discernable class characteristics, but insufficient for an identification. (2) Agreement of all discernable class characteristics without agreement or disagreement of individual characteristics due to an absence, insufficiency, or lack of reproducibility. (3) Agreement of all discernable class characteristics and disagreement of individual characteristics, but insufficient for an elimination.

Documentation: When an item will be reported as insufficient for identification or elimination, marks that are present should be photographed or described in detail, with documentation for the reason(s) why the marks are insufficient.

5.6.3.3 Elimination

Criteria: Significant disagreement of discernable class characteristics and/or individual characteristics.

Documentation: When an item will be reported as an elimination, differences in marks that are present should be photographed or described in detail, with documentation for the reason why the marks are eliminated.

5.6.3.4 Unsuitable

Criteria: Evidence bears no marks suitable for microscopic comparison.

Documentation: When evidence bears no marks suitable for microscopic comparison the documentation of the determination will be recorded in examiners notes.

5.6.3.5 Documentation of Results

Record interpretation of results in case notes

5.6.4 Verifications

All identifications will be verified by a second examiner. Documentation shall be in the form of a notation handwritten by the verifying examiner and shall delineate the item numbers, the actual type of markings (e.g., breech face markings, firing pin impression, ejector, extractor, chamber markings) for cartridge/shotshell case evidence, or the index mark for striated bullet or toolmark evidence, along with the verifying examiner's initials and date. No photographs or verification by a second examiner is needed for evidence classified as unsuitable.

Disputed verifications will be referred to the Section Supervisor or will be elevated to the Section Chief for final determination.

5.6.5 Reporting Formats

5.6.5.1 Firearm Function and Trigger-Pull Examination

The item __ pistol/revolver/rifle/shotgun was examined, found to be in mechanical operating condition with the safety feature(s) functioning properly, and test fired.

The trigger pull of the item __ pistol/revolver/rifle/shotgun was determined to be approximately three and one-half (3 1/ 2) pounds for single-action, and fourteen (14) pounds for double-action.

As received, the item __ pistol/revolver/rifle/shotgun does not function because of a missing _____. Parts from a reference firearm were used to replace the missing parts in item __. The item __ pistol/revolver/rifle/shotgun was then test fired.

5.6.5.2 Disposition of Tests

Analysis of tests produced from ammunition submitted, as evidence will be reported in the Certificate of Analysis as follows:

> [number ( )] of the item [ ] cartridges/shotshells were used for test firing purposes. The resultant ammunition components are being returned with the evidence and should be maintained for possible future examinations.

Analysis of tests produced from laboratory stock ammunition will be reported in the Certificate of Analysis as follows:

[number ( )] cartridges/shotshells from laboratory stock ammunition were used for test firing purposes. The resultant ammunition components are being returned with the evidence and should be maintained for possible future examinations.

Analysis of tests produced from ammunition submitted as evidence and tests produced from laboratory stock ammunition:

[number ( )] of the item [ ] cartridges/shotshells and [number ( )] cartridges/shotshells from laboratory stock ammunition were used for test firing purposes. The resultant ammunition components are being returned with the evidence and should be maintained for possible future examinations.

5.6.5.3 Positive Identification of a Bullet to a Firearm

The item __ bullet was identified as having been fired from the item __ revolver.

5..6.5.4 Elimination of a Bullet to a Firearm

Because of a difference in caliber and/or class characteristics, the item __ bullet jacket could not have been fired from the item __ pistol.

5.6.5.5 Cannot Identify or Eliminate a Bullet to a Firearm

The item __ bullet has the same class characteristics as those produced by the item __ pistol, however, it was not possible to identify or eliminate this bullet as having been fired from the above pistol.

5.6.5.6 Elimination of a Bullet to a Bullet

Because of a difference in caliber and/or class characteristics, the item __ bullet could not have been fired from the same firearm as the item __ bullet.

Because of differences in class characteristics, the item __ bullet was eliminated as having been fired from the same firearm as the item __ bullet.

5.6.5.7 Identification of a Bullet to a Bullet

Items __, __ and __, each a caliber ____ bullet/bullet jacket, were identified as having been fired from the same firearm.

5.6.5.8 Cannot Identify or Eliminate a Bullet to a Bullet

The item __ bullet has the same class characteristics as the item __ bullet, however, because of the lack of sufficient suitable corresponding microscopic markings, it was not possible to identify these bullets as having been fired from the same firearm.

5.5.5.9 Identification of Pellets

The item __ pellets are consistent in size and weight with number 6 lead shot pellets.

5.6.5.10 Unsuitable for Identification with a Firearm

The item __ lead fragment/bullet jacket fragment is not suitable for identification with any firearm.

5.6.5.11 List of Possible Firearms

GRC list when no firearm is submitted with a bullet

Item __ is a caliber __ lead round nose bullet which was fired from a firearm having a barrel rifled with five (5) lands and grooves inclined to the right. Firearms that produce general rifling class characteristics like those present on item __ include, but are not limited to, caliber 357 Magnum and/or 38 Special revolvers with the names Smith & Wesson, Taurus, I. N. A. and Ruger.

5.6.5.12 Identification of a Cartridge Case/Shotshell Case to a Firearm

The item __ cartridge case/shotshell case was identified as having been fired in the item __ pistol/revolver/rifle/shotgun.

5.6.5.13 Elimination of a Cartridge Case/Shotshell Case to a Firearm

Because of differences in class (caliber/gauge) and/or individual characteristics, the item __ cartridge case/shotshell case could not have been fired in the item __ pistol/revolver/rifle/shotgun.

5.6.5.14 Cannot Identify or Eliminate a Cartridge Case/Shotshell Case to a Firearm

The item __ cartridge case/shotshell case exhibits the same class characteristics as those produced by the item __ pistol/revolver/rifle/shotgun; however, because of the lack of sufficient suitable corresponding microscopic markings, it was not possible to identify this cartridge case/shotshell case as having been fired in item __.

5.6.5.15 Identification of a Cartridge/Shotshell to a Firearm

The item __ cartridge/shotshell was identified as having been chambered and extracted from the item __ pistol/rifle/shotgun.

5.6.5.16 Cannot Identify or Eliminate a Cartridge/Shotshell to a Firearm

There are no marks present on the item __ cartridge/shotshell which are suitable to determine whether or not it was chambered in and/or extracted/ejected from the item __ pistol/rifle/shotgun.

5.6.5.17 Identification of a Cartridge Case/Shotshell Case to a Cartridge Case/Shotshell Case

The item __ and __ cartridge cases/shotshell cases were identified as having been fired in the same firearm.

5.6.5.18 Elimination of a Cartridge Case/Shotshell Case to a Cartridge Case/Shotshell Case

Because of a difference in class (caliber or gauge) and/or individual characteristics, items __ and __ cartridge cases/shotshell cases could not have been fired in the same firearm.

5.6.5.19 Cannot Identify or Eliminate a Cartridge Case/Shotshell Case to a Cartridge Case/Shotshell Case

The item __ cartridge case/shotshell case exhibits the same class characteristics as those present on the item __ cartridge case/shotshell case; however, because of the lack of sufficient suitable corresponding microscopic markings, it was not possible to identify or eliminate items __ and __ as having been fired in the same firearm.

5.6.5.20 Shortened Barrel Shotgun

Examination of the item __ shotgun revealed it to be in mechanical operating condition with the safety feature(s) functioning properly and test fired. The barrel of this shotgun has been shortened to an approximate length of _____ inches. The stock has also been shortened making the overall length approximately _____ inches. The item __ shotgun is a smooth bore firearm originally designed to be fired from the shoulder and is capable of firing, with a single function of the firing device, a projectile of approximately __ caliber or shotshells containing various pellet loads.

5.6.5.21 Identification of a Toolmark to a Tool

The item __ toolmark was identified as having been produced by the item __ hammer.

5.6.5.22 Elimination of a Toolmark to a Tool

Because of a difference in class and/or individual characteristics, the item __ ,__ or __ toolmarks could not have been produced by the item __ screwdriver.

5.6.5.23 Cannot Identify or Eliminate Toolmark to a Tool

Toolmark(s) present on the item __ piece of cut wire exhibit similar class characteristics as those produced with the item __ wire cutters; however, because of the lack of sufficient suitable corresponding microscopic markings, it was not possible to determine whether or not the item __ wire cutters produced the toolmark(s) on the item __ piece of wire.

5.6.5.24 Cannot Identify or Eliminate Toolmark to a Toolmark

The item __ toolmark exhibits the same class characteristics as those present on the item __ toolmark; however, because of the lack of sufficient suitable, corresponding microscopic markings, it is not possible to identify or eliminate items __ and __ as having been produced by the same tool.

5.6.5.25 Identifying Class Characteristics of a Toolmark

The toolmarks on the item __ safe door were made by a prying type tool with a flat-bladed tip, approximately one (1) inch in width.

5.7 Appropriate Appendices

Appendix - Calibration Standards

Appendix - Work Sheets

5.8 References

Association of Firearm and Toolmark Examiners Glossary, 3rd ed. 1994.

DeForest, Gaensslen, and Lee. Forensic Science: An Introduction to Criminalistics, New York: McGraw-Hill. 1983.

Howe, Walter, J. “Laboratory Work Sheets”. AFTE NEWSLETTER. No.2. August 1969, p. 13.

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